Livestock Research for Rural Development 26 (1) 2014 | Guide for preparation of papers | LRRD Newsletter | Citation of this paper

Mithun: An Animal of Indian Pride

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Abstract

Mithun, also known as 'Cattle of Mountain" is an important bovine species of north-eastern hill region of India and also of China, Myanmar, Bhutan and Bangladesh. This magnificent massive bovine is presently reared under free-range condition in the hill forests at an altitude of 1000 to 3000 m above mean sea level. Mithun plays an important role in the socio-economic and cultural life of the local tribal population. Presently, this animal is mainly reared for meat, which is considered to be more tender and superior over the meat of any other species. Mithun milk, though produced less in quantity, is of high quality and can be used for preparation of various milk products. Leather obtained from this species has been found to be superior to cattle.

With the dwindling population of Mithun over the years and gradual denudation of free range area along with the biotic and abiotic stress, there is urgent need of scientific intervention for proper management as well as conservation of this beautiful hill animal through implementing an effective conservation program.

Key words: *conservation, meat, milk, propagation, rare ruminant*

Introduction

India at large and specifically the North-East India is the hotspot of floral and faunal biodiversity and the habitat of a number endemic species. Of these species, Mithun (*Bos frontalis*) is an important one which needs support for healthy propagation. However, due to denudation of free range along with the biotic and abiotic stress, there is urgent need of scientific intervention for proper management as well as conservation of this beautiful hill animal through implementing an effective conservation programme. Biotechnologies such as cryopreservation of semen and embryos, coupled with artificial insemination and embryo transfer are important potential tools for the preservation of animal biodiversity. Frozen semen technology offers a very potent means of *in vitro* conservation of male germplasm.

Mithun is a massive semi-domesticated rare ruminant species mainly reared for meat. This strongly built hill animal of Southeast Asia plays an important role in the socio-economic and cultural life of the local population (Simoons 1984, Mondal and Pal 1999, Mondal et al 2004, 2005a-e, 2006a-f, 2008, 2010). In India, Mithun meat is considered to be more tender and superior over the meat of any other species. At present, Mithun farmers rear this animal at an altitude of 1000 to 3000 meters above mean sea level under free grazing condition in its natural habitat. Due to gradual denudation of forests (natural habitat of Mithun) and tremendous socio-economic and cultural importance of Mithun in the life of the local tribal population, very recently initiatives are being taken to popularise economic Mithun farming under semi-intensive condition with controlled breeding. While wild Indian Gaur, the ancestor of Mithun, is in a vulnerable position (Baillie and Groombridge 1996), Mithuns are subject to non-cyclical population decrease and local-regional contractions, indicative of this species or its population that are not yet endangered, but may become so in the near future. With a decline in population size, inbreeding can occur which, in turn, can reduce reproductive fitness (Nei et al 1975), including fecundity and survivability (Ralls and Ballon 1986). Furthermore, the present free ranging Mithun rearing system permits grazing of limited number of these animals in a particular hill pocket without any migration to other locations and vice versa that results in considerable inbreeding in this species. When genetic variation is maintained or increased, population vigour and the ability to adapt to environmental change are enhanced. Grazing of local cattle together with Mithun in the same forest area increased the chance of crossbreeding with the local cattle that may result in a loss of species uniqueness and specialized adaptive and fitness traits, and failure to response in captivity owing to behavioural problems associated with confinement (Hediger 1965). In addition, very recently slaughtering of Mithun on regular basis for meat imposed further threat on the future population size of this species.

Origin and distribution of Mithun

Mithun is believed to have originated more than 8000 years ago and considered to be descendent from wild Indian gaur (Simoons 1984, Mondal and Pal 1999). Mithuns are found over a large area of Southeast Asia. Beside meat, Mithuns are reared for sacrificial purposes and/or for barter trade. Their natural habitat is the forests of highlands. In some folklore, Mithun has been said to be the descendent of the Sun. Different interesting and divergent legends are available on the origin of Mithun among different tribes. Even today, Mithun is used as a holy sacrificial animal to appease the Gods by the tribesman. Mithun, a unique bovine species has a limited geographical distribution. It is mainly found in the tropical rain forests of North Eastern hilly states of Arunachal Pradesh, Nagaland, Manipur and Mizoram of India (Diagram 1).

Diagram 1. Mithun inhabited areas of the world (not in Scale)

Besides, it is also available in small numbers in Myanmar, China, Bangladesh and Bhutan (Diagram 1). At present, the population of Mithun in India is approximately 0.26 million. In the North Eastern Hill Region (NEHR) of India, Mithuns are distributed in four different States namely Arunachal Pradesh, Nagaland, Manipur and Mizoram. As per the quinquennial All India Livestock Census (1997), India had a total population of 1,76,893 Mithuns. Of the total population, the Arunachal State alone had 70.25% (1,24,194 heads). The Nagaland State had 18.86% (33,445 heads) followed by Manipur (9.42%; 16,660 heads) and Mizoram States (1.47%; 2,594 heads). It was seen from the census of the year 2003 that the country possessed 2,46,315 numbers of Mithun, which registered a growth rate of only 6.5% per year over the population reported in 1997 census and this growth rate is far below than those recorded during last census in 1997 over 1991 (growth rate: 24.56%) indicating declining trend of population of Mithun growth rates over the decades. In the recent census (2007), it has been noted that except Arunachal Pradesh, in all other three Mithun-inhabited States, percent contribution declined very drastically, particularly in Mizoram State, where the total number of Mithuns are less than 2000 heads (Table 1). These data suggest an immediate developmental and research attention to this species of animal through proper scientific rearing.

Table 1. Recent trends in Mithun population in India

State	1997	2003	2007
Arunachal	124,194	184,343	218,931

Nagaland	33,445	40,452	33,385
Manipur	16,660	19,737	10,024
Mizoram	2,594	1,783	1,939
Total	**176,893**	**246,315**	**264,279**

This animal prefers cold and mild climate. They are browsers like goats and can utilize coarse fodders, which are generally not consumed by other livestock. This is a very fertile animal, which can produce one calf in a year with age at puberty varying from 22 to 30 months. Their productive life ranges from 16 to 18 years. This is an underutilized animal and has a great potential for quality meat, milk and leather production. The quality of meat, milk as well as leather of this animal is very good and there is a great scope to promote this animal as an organic meat and milk producer. This animal is also used as bridal gift as well as in barter trade and the milk producing capacity of this animal also needs to be explored.

Strains of Mithun

As described by Verma (1996), two distinct types of Mithuns are available in India and they were named after the name of the State where they belong (Nagami and Arunachali). These two distinctive types have also been reported by Arora (1998). However, Bhusan et al (2000) have identified four distinct strains of Mithun and named them as Arunachalee, Mizorami, Nagami and Manipuri strain. The names indicate their home tract in northeastern States of India. As per the survey conducted by the National Research Centre on Mithun to identify different strains of Mithun in North Eastern Hills of India, four different strains have been identified (Figure 1). Characterization of these four different strains has been done based on 37 phenotypic characters and genetic characterization was done through RAPD. Results were suggestive of genotypic difference among four different strains.

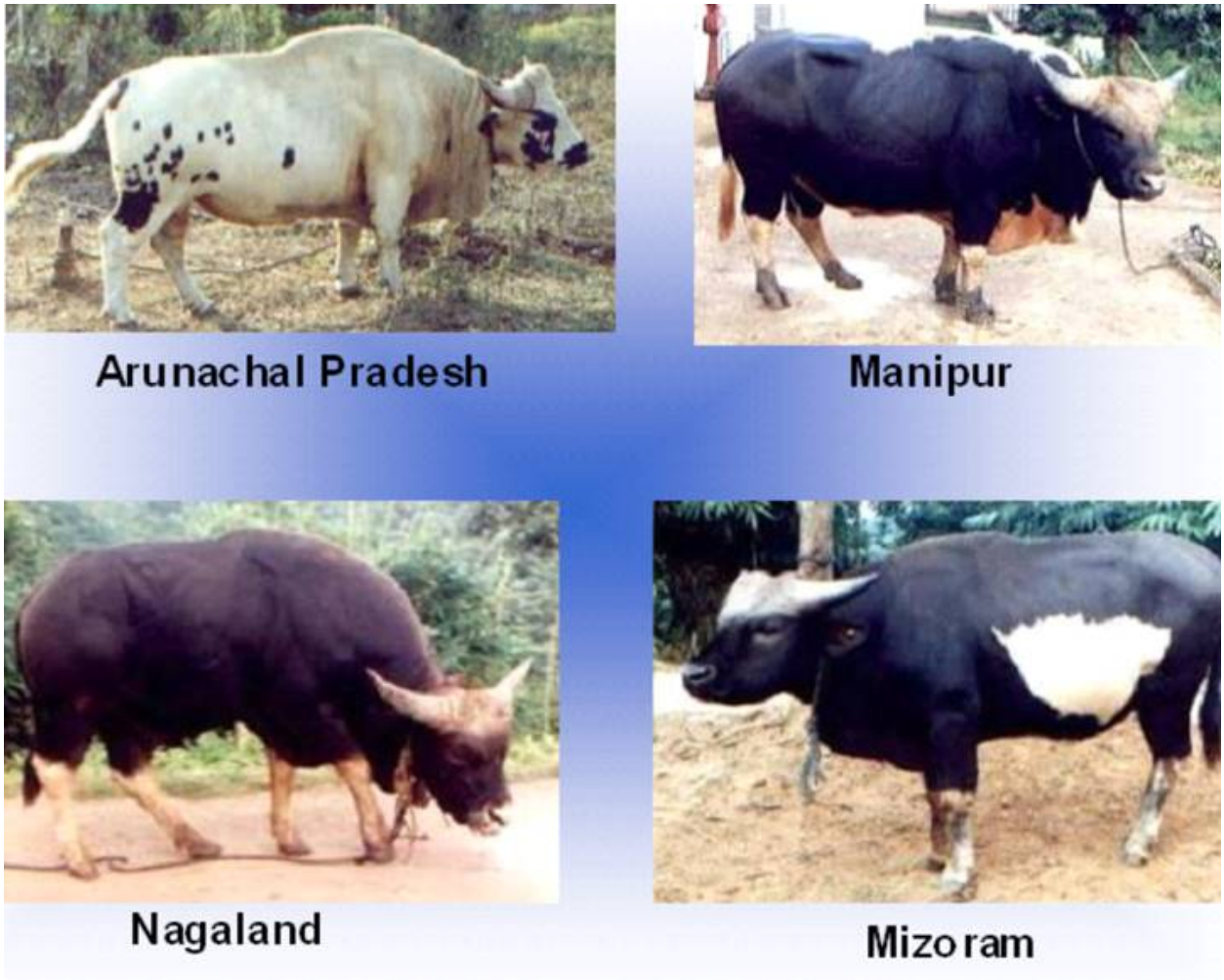

Figure 1. Four different strains of Mithun (*Bos frontalis*)

Socioeconomic importance of Mithun

Mithun is considered as the pride of North Eastern Hilly region of India. This animal plays an important role in the social, cultural and economic life of the local tribal population. The ownership of Mithun is considered to be the sign of prosperity and superiority of an individual in the society. Farmers mainly rear Mithun for meat purpose. Besides, this animal is also used as marriage gift and sacrificial animal for different social and cultural ceremonies. Though at present farmers do not consume its milk, this animal produces highly nutritious milk.

Being a meat animal the growth rate of Mithun is the prime concern of farmers. With adequate feeding the growth rate of this animal varies from 300 to 600 g/ day, which is comparable with cattle and buffalo. However, the plasma growth hormone concentration (30-90 ng/ ml) (Mondal et el 2004, 2005d, 2006a,c,d) is much higher in Mithun than in any other domesticated animals. The consumption of Mithun meat is not a regular practice in tribal society. These animals are sacrificed for meat only during important social ceremonies and festivals. However, there is a great demand for Mithun meat and consumers consider this meat as more tender and superior over the meat of any other species except pork. The dressing percentage in Mithun varies from 48 to 54 % in different age groups. However, to achieve an optimum dressing percentage, it is suggested to slaughter Mithuns at 4 to 5 years of age. There is a great scope to utilize this meat to make some value added meat products. The National Research Centre on Mithun has already standardised the process of making some value added products of meat like meat nuggets, meat powder, meat Patties as well as meat block. The organoleptic test conducted by the institute on these products revealed high scoring of 6-7 in the scale of 1-8.

Presently, the consumption of Mithun milk is not an accepted practice among its rearers. Mithun produces around 1 to 1.5 kg milk per day. However, Mithun milk is nutritionally superior to any other domesticated species as it contains high fat (8 to 13%), solid-not-fat (18 to 24%) and protein (5 to 7%). Hence, Mithun has a scope to be promoted as moderately good milk animal for home consumption in these hilly areas. Due to high fat and protein content in Mithun milk, it may be used for the preparation of different value added milk products such as paneer, various sweet products, ghee, cream, curd and cheese. The National Research Center on Mithun, the premier Institute of Indian Council of Agricultural Research, has successfully standardized the process of making paneer, barfi, rasgulla, curd and lassi from Mithun milk.

The quality of Mithun hide is found to be superior in comparison to the traditional cow hide (Das et al 2011). The National Research Centre on Mithun has successfully processed different varieties of leather from Mithun hide. Mithun hide has been found to be very good for the production of upper shoe leather, bag leather and garment leather. Bag leather has been found to be much superior to cow leather. Besides, Mithun hide with hairs could be an excellent exotic outer cover for a sofa.

Scientific rearing system

Currently farmers rear Mithun under free-grazing condition in the forest area without any additional housing or feeding facilities. Occasionally, farmers bring back the female Mithun just before parturition and send it back to the forest following parturition. However, it is suggested that even under a free-range system, a temporary housing structure using locally available materials can be constructed in some strategic locations in the Mithun rearing area. Mithun can also be trained to come to the shed at a particular time every day by providing little bit of concentrate and salt. This will be helpful for farmers to supervise, provide additional feeding and medication to their animals. Besides, farmers will also get an opportunity to look after the individual animal regularly for any kind of discrepancy or disorder. If farmers opt for semi-intensive system of rearing they should go for housing structures with feeding and watering provisions and they can also tie the animals at night once they come back from the forest after grazing. The supervision of individual animals, additional feeding, watering and medication can be done there in late evening or early morning.

Feeding management

Mithun thrives on the jungle forages, tree fodders, shrubs, herbs and other natural vegetations (Das et al 2010). Farmers do not provide any additional feeding. Though the animals are owned by the farmers, they are kept under natural forest in a semi-wild condition. However, farmers occasionally provide common salt, especially at the time of restraining for some purposes. Each individual owner can identify his Mithuns even though they do not bear any identification marks and similarly each Mithun knows his owner which is reflected in the fact that the Mithun approaches the owner periodically for salt. In other words, the owner does not have to invest anything in his Mithun as they are simply let loose in the forest which constitutes around 50 percent of total land area of the region. Owners generally keep Mithuns in community herd in fenced hilly jungle area and village councils assign Mithun grazers to take care of their animals.

As Mithun entirely depends on the locally available jungle fodders, special care should be taken in terms of mineral supplementation for better performances (Das et al 2010). In steep hilly slope, the leaching of mineral elements is a common phenomenon especially during rainy season. Therefore, in a particular hilly grazing gradient the soil will be deficient in some important mineral elements. In that case the vegetation of that particular area will also be deficient in some of the mineral elements, which may induce mineral deficiency. The only option to correct this situation is mineral supplementation. However, the salt licking behaviour as well as drinking of mineral water sources in the hills is the natural way to meet the requirement of minerals in these animals (Prakash et al 2013).

During the lean season, when availability of jungle fodders goes down, additional concentrate supplementation may be required. It is advisable that during the flush season when abundant fodders are available in the jungle, the salt and mineral mixture together may be fed additionally to the animals to avoid mineral deficiency. Whereas, during lean season additional concentrate feed (15% CP and 70% TDN) fortified with salt and mineral mixture (1 to 2 kg per animal daily up to 2 years and 2 to 4 kg per animal daily above 2 years) may be offered to maintain optimum performances (Das et al 2010). For lactating Mithun, as it produces less quantity of milk, no additional feeding is required. In free-range Mithun, these feed supplements may be provided to the animals in the shed constructed in strategic location in the grazing area. Whereas, for animals under semi intensive system the feed supplements may be provided in the shed in late evening or early morning whenever the animals are tied. It has been found that the drinking water requirement for Mithun is approximately 9% and 12% of body weight, during winter and summer respectively. Therefore, the provision of adequate drinking water according to this specification is highly essential.

Breeding management

Like cattle, Mithun is a poly-estrus animal. The healthy adult female Mithun show repeated estrus cycles at an interval of 19 to 24 days unless it is pregnant. The Mithun breeds throughout the year and no definite breeding season is observed in this species. The length of gestation period, service period and calving interval in Mithun varies from 270 to 290 days, 50 to 100 days and 350 to 400 days, respectively. The age at puberty and age at first calving varies from 27 to 36 months and 40 to 48 months, respectively. The Mithun bulls become mature to breed at 3 to 4 years of age. Under free-range system, a practical approach for selective breeding in Mithun is the introduction of superior and tested bulls (1 bull for 10 breedable females) in the herd and simultaneous culling of the unwanted bulls from the herd. Efforts should be made to replace breeding bulls preferably once in five years to avoid inbreeding depression. Under semi intensive system, the female can be detected in heat to be bred with superior bulls either through natural service or artificial insemination.

The expression of estrus behaviour is silent in Mithun (Mondal et al 2008). Unlike cattle, it is difficult to detect heat in Mithun through visual observations. Among all the behavioral signs of estrus, the mounting of Mithun bull over estrus cow is the best indicator of estrus followed by standing of estrus cow to be mounted by Mithun bull. Congestion of vulval mucous membrane and swelling of vulva are also important signs of estrus in Mithun cows. In contrast, other signs like mucous discharge, restlessness and alertness, tail raising, frequent urination and loss of appetite were found to be less prominent estrus signs in Mithun cows (Mondal et al 2008). Bellowing is not generally observed in Mithuns during estrus. The genital organ of Mithun cows during estrus reveals relaxed and open os externa of cervix, turgid uterus and ovaries having palpable follicles. However, it is suggested to use healthy Mithun bulls to detect heat. In Mithun, ovulation occurs between 20 to 31 hour after the onset of estrus (Mondal et al 2006b,e,f).

Conservation of Mithun

Keeping in view the dwindling population of Mithun over the years, it is of great priority for the Mithun inhabited states to conserve and propagate quality Mithun germplasm at faster rate to stabilize its population. There are three ways for the conservation of Mithun genetic resources: i) through cryopreservation of genetic material like living ova, embryos or semen; ii) preservation of genetic information as DNA; and iii) conservation of live population (*in situ* conservation).

The need for parallel conservation of Mithun genetic resources along with live animal conservation, as raw material for future breeding programmes, should be recognized and has become an important issue in planning of Mithun husbandry. Conservation is of particular concern in the Mithun inhibited regions where there is effort for agricultural change, thereby the risk of gradual replacement of indigenous stocks and farming methods by new techniques. These areas, where climatic extremes and particular parasitic conditions may result in genetically modified and unique local stocks which are able to survive under extreme conditions, need to be given proper attention. Such conservation efforts are particularly important in the light of predicted global climate change, and the ability of microbial and insect parasites to evolve and adapt to modern chemical control methods.

Need for conservation

"The management for human use of the biosphere so that it may yield the greatest sustainable benefit to present generations while maintaining its potential to meet the needs and aspirations of future generations. Thus conservation is positive, embracing preservation, maintenance, sustainable utilization, restoration and enhancement of the natural environment." (International Union for the Conservation of Nature 1980). The FAO definition of animal genetic resources includes sheep, goats, cattle, pigs, buffalo and poultry. Horses, donkeys, camels, elephants, reindeer and other domesticated animals are given less attention and are often considered to be of marginal interest. In fact the FAO definition includes all these domesticated species and those species on the fringe of domestication or with potential for domestication. It incorporates, for example, a number of Asian ungulates including the Banteng, Mithun, Yak and Gaur (Veitmeyer 1983).

Reason for conservation

The FAO definition of animal genetic resources eligible for conservation includes animal populations with economic potential, scientific use and cultural interest. Mithun fulfills all of these criteria. Populations like Mithun need conservation for their potential economic use in the future. Their economic potential is the production of meat and milk. This potential production may be in diverse climatic and environmental conditions. These adaptations may be beneficial in other areas of the world where similar or complementary conditions exist. From the cultural point of view, Mithuns are of great importance, being used for marriage gift and also serving as a prestigious asset of the owner.

Economic potential cannot be measured by looking simply at performance. Mithun are highly adaptedto their environment and their performance should be measured comparatively, within their own environmental conditions. They should not be compared with other breeds of animals in improved or modified conditions or under intensive management. Furthermore, they should be examined with respect to the products for which they were selected and valued in the conditions under which they evolved.

Mithun should be conserved for their possible scientific use. This may include the use of conservation stocks as control populations, in order to monitor and identify advances and changes in the genetic makeup and production characteristics of selected stocks. The studies in National Research Centre on Mithun include physiology, nutrition and reproduction. Studies are also essential for climatic tolerance at the physiological and genetic level. Genetically distinct breeds are also needed for research into disease resistance and susceptibility which could help in the development of better medication or management of disease. It could also help with the identification of specific genes involved in natural disease or parasite control. Some populations may also be used as research models in other species, including man. This is already the case in the use of Ossabaw Island Hogs in the USA. These feral pigs from an isolated island off the east coast of the USA have been shown to have a natural insulin disorder making them a useful research model for human diabetes (Brisbin 1985).

Many populations have played an important role in specific periods of national or regional history. Mithun plays an important role in cultural ethos of tribal population of these North Eastern hill states of the country.

Objectives for conservation

The idea of conserving Mithun genetic resources may be focused on two separate but interlinked concepts. The first is the conservation of 'genes' and the second, the conservation of 'breeds' or populations. The conservation of 'genes' refers to action to ensure the survival of individual genetically controlled characteristics inherent within a population or group of populations. Such programmes require that a specific characteristic to be conserved is clearly recognized and identified. A characteristic can be identified in the appearance or function of the animals that exhibit it, and a programme can be developed to conserve it as a gene within the population.

The conservation of populations or breeds refers to actions to ensure the survival of a population of animals as defined by the range of genetically controlled characteristics that it exhibits. This form of conservation is applied to ensure the conservation of all the characteristics inherent with a given population, including many which may not have been recognized, defined, identified or monitored. The differences between breeds may often be due to differences in the frequency of quantitative genes rather than the presence or absence of unique genes. Such a difference in gene frequency may result in dramatically different populations with respect to appearance and

production in a given environment. For conservation of this species, efforts have been made to collect and preserve Mithun semen in the National Research Centre on Mithun.

Ex situ versus in situ methods of conservation for Mithun

Ex situ preservation involves the conservation of Mithun in a situation removed from their normal habitat. It is used to refer to the collection and freezing in liquid nitrogen of animal genetic resources in the form of living semen, ova or embryos. It may also be the preservation of DNA segments in frozen blood or other tissues. Finally it may refer to captive breeding or other situations far removed from their indigenous environment.

In situ conservation is the maintenance of live populations of animals in their adaptive environment or as close to it as is practically possible. For domestic species the conservation of live animals is normally taken to be synonymous with *in situ* conservation

Ex situ conservation

In effect, this is the storage of animal genetic resources, which farmers are currently not interested in using. It includes cryogenic preservation and the maintenance of breeds from domesticated species as live-animal populations in parks, zoos and other locations away from the environment in which they are being developed. The global programmes on *ex situ* conservation strategy is still being developed, but it is based on the use of live-animal populations wherever practicable, supported by cryopreservation where technology exists or can be developed, combining within-country gene banks with global repositories of last resort. This strategy is in keeping with the Convention on Biological Diversity. A range of animal health issues must be overcome, however, before much international storage of and access to such material can be effective for the domestic animal species. The technology required for storing both male and female gametes of all species of interest is not yet developed. Of course, interested governments, non-governmental organizations, research institutions and private enterprises will be encouraged to maintain *in vivo* samples of breeds at risk, with national inventories being established and kept up to date so that the genetic resources are readily available for use and study.

Conclusions

- Mithun husbandry in North Eastern hill region of India is an important component of the livestock production system. Scientific rearing of this species will not only support the need of protein but also help to generate extra income to the poor Mithun rearers for their livelihood. The need of the hour is, therefore, to popularize scientific farming in the states where Mithun rearing is an age-old practice. The recent success in the field of artificial insemination, estrus synchronization coupled with timed AI and embryo transfer technology will definitely help to go a long way to achieve the target of propagating quality germplasm in the farmers' field.

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Received 29 November 2013; Accepted 24 December 2013; Published 1 January 2014

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